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[54] **METHOD AND APPARATUS FOR CONTROLLING VIDEO/AUDIO AND CHANNEL SELECTION FOR A COMMUNICATION SIGNAL BASED ON TEXTUAL INFORMATION INDICATIVE OF CHANNEL CONTENTS OF A SIGNAL**

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Related U.S. Application Data

[63] Continuation of Ser. No. 338,429, Nov. 14, 1994, abandoned.

[51] **Int. Cl.⁶ H04N 7/173**

[52] **U.S. Cl. 348/1; 348/10; 348/12; 455/2; 455/6.2**

[58] **Field of Search 348/1, 2, 5, 6, 348/7, 12, 13, 10, 11, 461, 460, 465, 468, 473, 478, 552, 563, 564, 565, 906; 455/2, 4.2, 3.1, 5.1, 6.1, 6.2, 6.3; 358/84, 85, 86; 395/200.47, 200.48, 200.49; 345/2; 386/46, 83; H04N 7/16, 7/173**

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[57] **ABSTRACT**

A signal processing unit is provided with one or more analyzing units to analyze textual information decoded from a number of channels of a communication signal to determine if channel contents of the channels are among channel contents defined by selection data. The signal processing unit is further provided with an arbitrating unit for arbitrating display and/or recording resource contentions among channels having channel contents defined by the selection data. The signal processing unit is suitable for incorporation in a stand-alone as well as a client computer system.

26 Claims, 3 Drawing Sheets

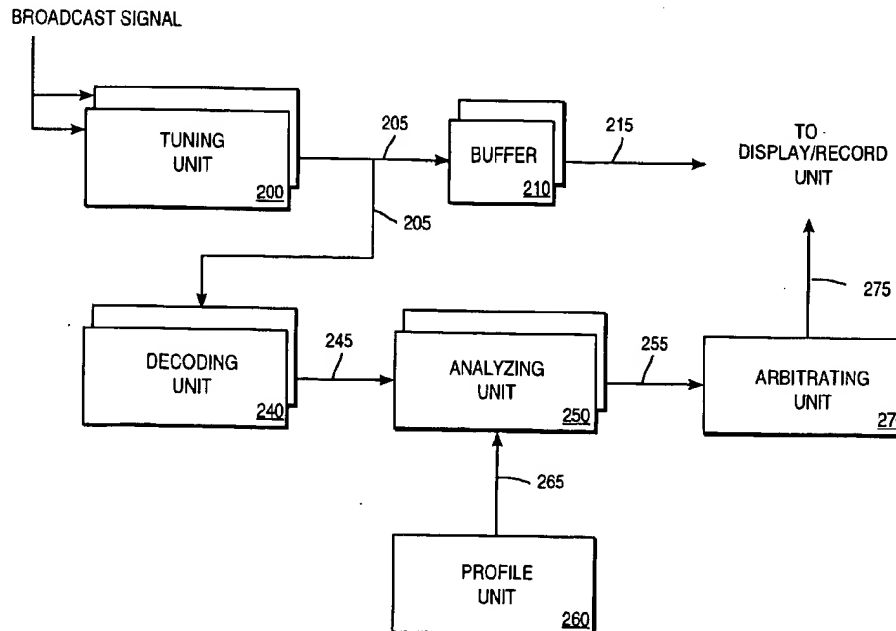


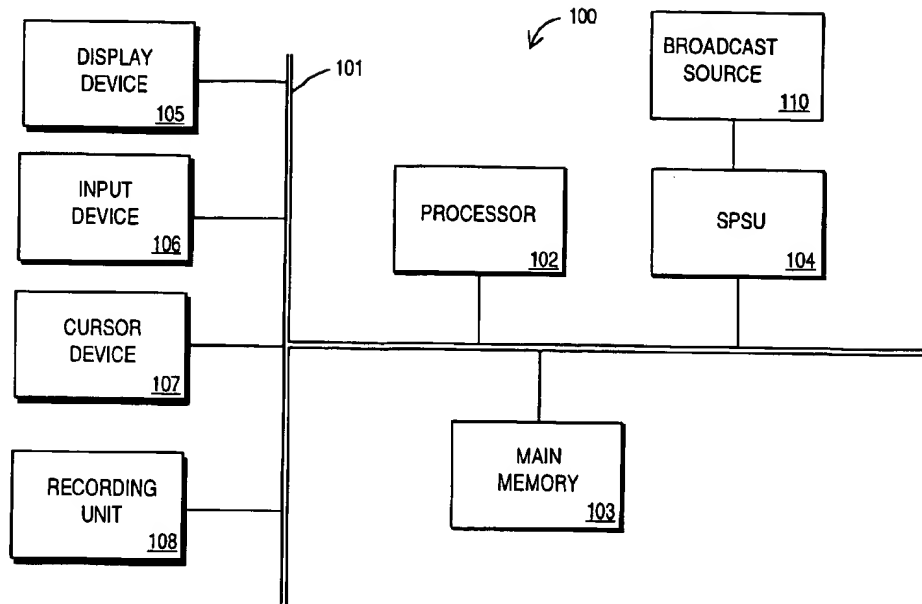
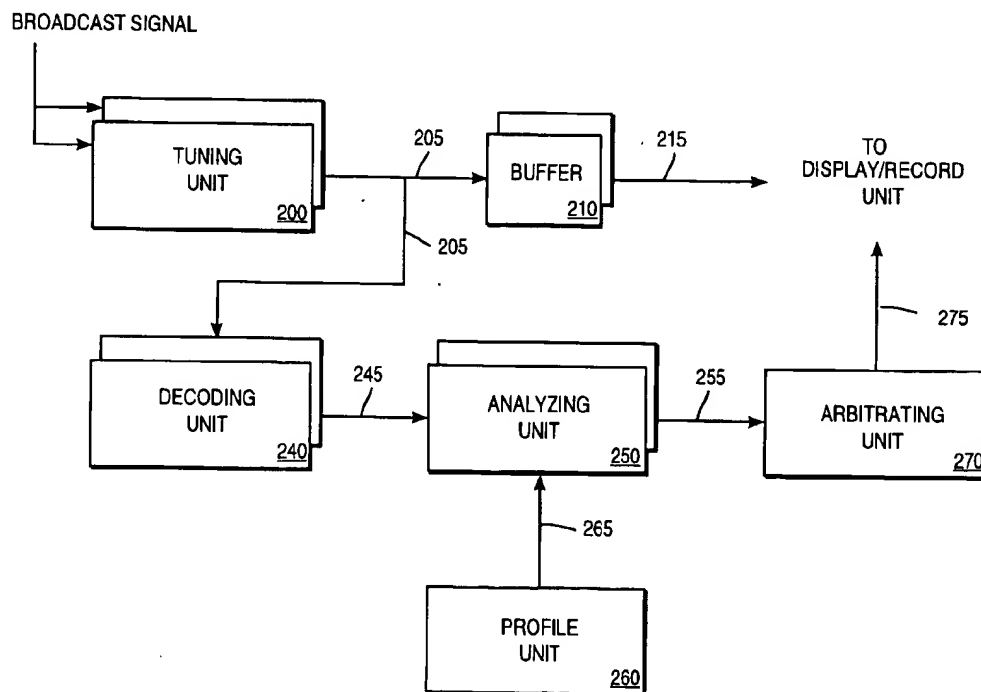
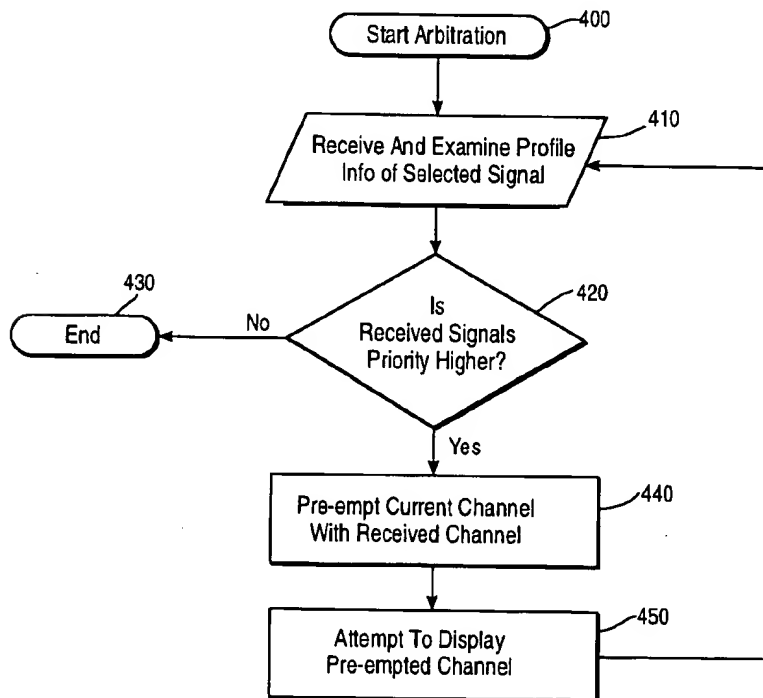
FIG. 1**FIG. 2**

FIG 3

The screenshot shows a window titled "Personal Profile". Inside, there is a section labeled "Profile" containing a table with four columns: Priority, Channel, Trigger, and Action. The table lists six entries. Below the table are two buttons: "Add-New" and "Delete". At the bottom of the window are three buttons: "OK", "Cancel", and "Hold".

Priority	Channel	Trigger	Action
1	CNN	"War Started" or "President Dies"	Video ON, Audio ON, Maximize, Record
2	ESPN	"Cubs Win"	Video ON, Audio ON, Maximize
3	CNN	"Intel Corporation"	Record
4	CBS	"War Started" or "President Dies"	Video ON, Audio ON, Maximize, Record
5	CSPAN	"Balanced Budget"	Audio ON
6	CNN	"O.J. Simpson"	Audio OFF

FIG 4

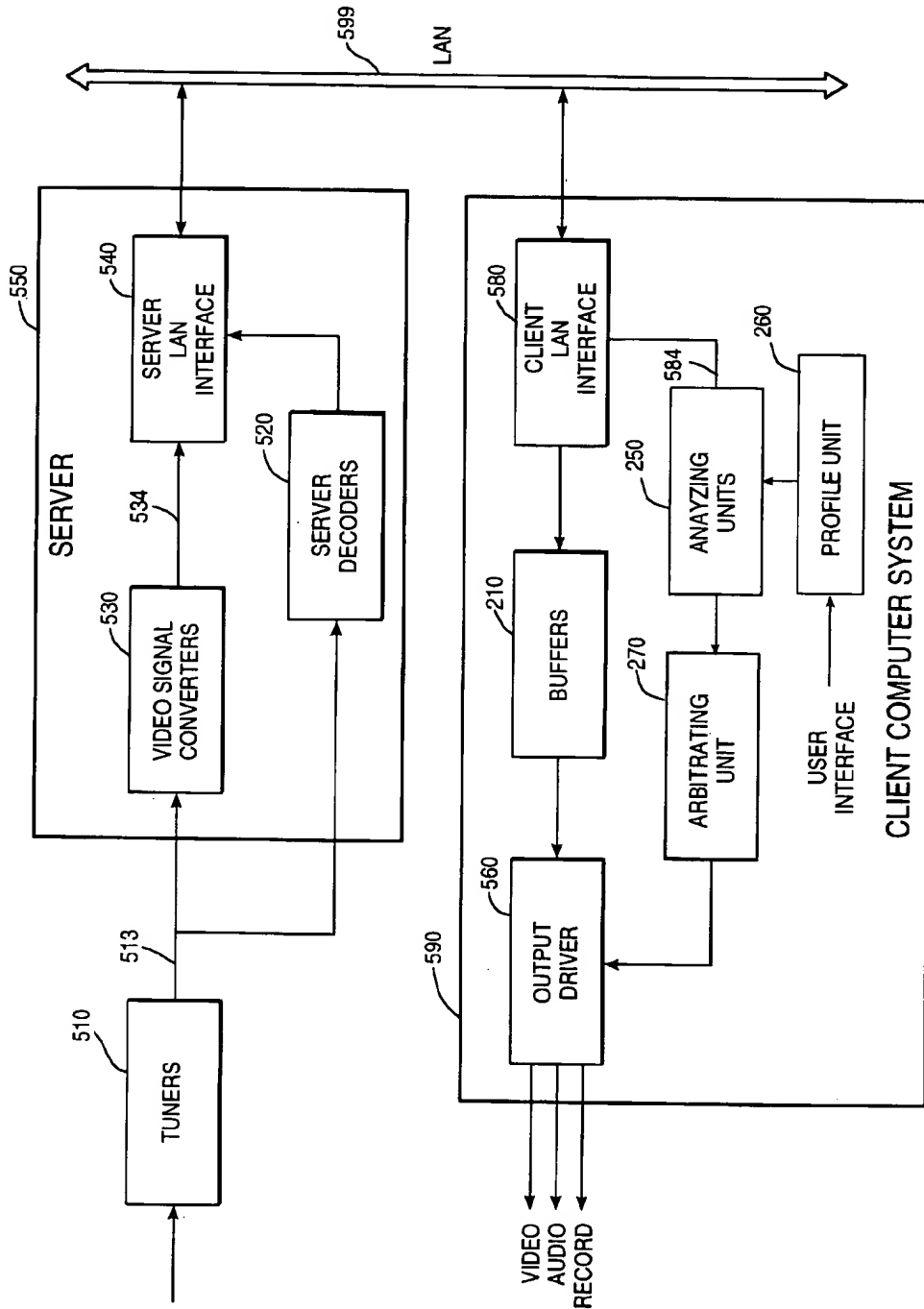


FIG. 5

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**METHOD AND APPARATUS FOR
CONTROLLING VIDEO/AUDIO AND
CHANNEL SELECTION FOR A
COMMUNICATION SIGNAL BASED ON
TEXTUAL INFORMATION INDICATIVE OF
CHANNEL CONTENTS OF A SIGNAL**

This is a continuation/divisional of application Ser. No. 08/338,429, filed Nov. 14 1994 now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of communications technology. More specifically, the present invention relates to controlling and selecting communication signals based on the textual contents of the signal.

2. Description of Related Art

Current users of audio/video systems can view a broad spectrum of information including news broadcasts, sports events, etc. on a television set (TV). The same information shown on a TV can be recorded in a video cassette recorder (VCR) by the user. In most traditional televisions, the user can only watch one channel at a time, while in the more advanced picture-in-picture (PIP) televisions, the user can simultaneously watch two channels. In most of these traditional TVs, the user is typically limited to manually selecting channels and adjusting the audio volume associated with a channel. Even in the PIP television, the user still is limited to watching and listening to one channel simultaneously.

To record a program in a VCR, the user is limited to either preprogramming the VCR to record a program using a time stamp to record the entire program without regards to the contents of the program, or manually setting record buttons on the VCR to record a program currently being watched by the user.

The proliferation of multimedia technology has enabled the incorporation of current TV technology into personal computers (PC) that allow the PC user to receive and display TV signals. The multimedia PC could also be used to record TV signals. However, despite the new uses of TV technology, PC users who use their PCs as TV units still encounter the limitations imposed by traditional TVs (i.e., limited displays and sequentially viewing programs).

Furthermore, indiscriminately recording a program in a PC requires additional storage space especially if programs are recorded without regard to the contents of the program. The additional requirement for extra storage space for recording TV programs in these multimedia PCs can be very expensive. Thus, it would be beneficial to efficiently utilize storage space needed to record a program being received by the PC.

To take advantage of the available audio/video technologies in a multimedia environment and permit monitoring multiple channels simultaneously and being able to discern information carried by each channel being monitored, a system is needed that will allow the user to capture and automatically display or record an video/audio signal based on the textual contents of the multiple channels.

SUMMARY OF THE INVENTION

A signal processing unit is provided with one or more analyzing units to analyze textual information decoded from a number of channels of a communication signal to determine if channel contents of the channels are among channel contents defined by selection data. The

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signal processing unit is further provided with an arbitrating unit for arbitrating display and/or recording resource contentions among channels having channel contents defined by selection data.

In one embodiment, the signal processing unit further includes one or more tuners for tuning to the channels of the communication signal, and one or more decoders for decoding textual information included in the channels.

In one embodiment, the signal processing unit is provided to a stand-alone computer system. In another embodiment, the signal processing unit is provided to a networked client computer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram illustrating an overview of a computer system utilized by one embodiment of the preferred embodiment.

FIG. 2 is a block diagram illustrating one embodiment of the signal processing system for controlling and selecting audio/video signal in the preferred embodiment.

FIG. 3 is a block diagram illustrating one embodiment of information stored in the profile unit.

FIG. 4 is an exemplary flow chart illustrating the method of arbitration utilized by one embodiment of the arbitration unit.

FIG. 5 is a block diagram illustrating an exemplary local area network implementation of the signal processing system of one embodiment.

**DETAILED DESCRIPTION OF THE
PREFERRED EMBODIMENT**

FIGS. 1 through 5 of the drawings disclose various embodiments of the present invention for purposes of illustration only. One skilled in the art will readily recognize from the following discussion that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles of the invention.

Overview of the Computer System

Referring to FIG. 1, a block diagram illustrating a computer system as may be utilized by the preferred embodiment of the present invention is shown. The computer system 100 is a multimedia computer generally comprising a bus 101 for communicating information, a processor 102 coupled to the bus 101 for processing data and instructions, a main memory 103 coupled to the bus 101 for storing data and instructions for the processor 102 and other devices coupled to the bus 101, a signal processing and selection unit (SPSU) 104 coupled to the bus 101 for monitoring and selecting audio/video signals received by the computer system 100 from a signal broadcast source 110 such as a television antenna. Although the SPSU 104 is illustrated in a computer system, the SPSU 104 of the preferred embodiment may be embodied in a conventional television set or a video cassette recorder which includes components, such as the processor 102 and the main memory 103.

The computer system also comprises a display device 105 coupled to the bus 101 for displaying information to the computer user. The display device 105, which may be a conventional personal computer monitor, displays a plurality of digital images at any given time in multiple display windows in Windows™ or any other display application program. The computer system also comprises an alphanumeric

meric input device 106 for communicating information and command selections to the processor 102, a cursor control device 107 also coupled to the bus 101 to allow the computer user to dynamically signal the two dimensional movement of a visible symbol on the display screen of the display device 105, and a recording unit 108 coupled to the bus 101 for optionally recording an audio/video signal received in the computer system 100 from a broadcast source 110.

FIG. 2 illustrates an exemplary SPSU 104 comprising a plurality of tuning units 200 for receiving audio and video signals (television signals) and monitoring the available video signals for subsequent display/record in a display/record unit. Each of a plurality of buffer units 210 is coupled to each of the tuning units 200 for temporarily storing the television signals supplied by the tuning units 200 to the display/record unit. The display/record unit is utilized to display or record the television signals received by the SPSU 104. For example, the display/record unit shown in FIG. 2 may be a multimedia personal computer with multiple display windows, a television set screen capable of displaying multiple pictures, or a video cassette recorder.

The SPSU 104 further comprises a plurality of decoding units 240 coupled to the tuning units 200 via signal lines 205. The decoding unit 240 receives video signals from the tuning unit and converts (decodes) the signals into text streams. From the decoding units 240 decoded signals 245 are provided to a plurality of analyzing units 250. Responsive to the decoded signals 245 and predefined profile information, the analyzing units 250 determine whether the video signals being monitored by the tuning units 200 include predefined items of interest to the user. The analyzing units 250 are coupled to a profile unit 260 via lines 265. The profile unit 260 stores profile information that includes a prioritized list of predefined channels and text captions that specify items of interest to be monitored by the tuning units 200 and the decoding units 240.

The analyzing units 250 are also coupled to an arbitrating unit 270 via lines 255. The arbitrating unit 270 resolves display contentions between one or more analyzing units contending for the display/record unit when one or more predetermined items of interest are detected by the decoding units 240 and the analyzing units 250. From the arbitrating unit 270 selected signals 275 are provided to the display/record unit to display or record based on the user's profile information stored in the profile unit 260.

As an example of how SPSU 104 operates, the tuning units 200 receive video signals in a broadcast signal from a transmission source such as a television broadcasting station. The tuning unit 200 selects one channel out of several being broadcast and received by the preferred embodiment for display/record on the display/record unit. The tuning unit 200 also monitors the television signal being received by the preferred embodiment. After receiving the broadcast television signals, the tuning unit 200 generates output signals to the buffer 210 for temporary storage for the display/record unit and to the decoding unit 240 to be decoded.

The decoding unit 240 receives the monitored video signals from the tuning unit 200 and decodes (converts) the video signal into text indicative of the contents of the signals received by each channel being monitored. Decoding video signal is well known in the art and will not be discussed in detail. For example, many traditional televisions provide programs that are closed-captioned for the hearing impaired. The information transmitted to a closed-captioned television according to federal standards (USFCC regulations 47 C.F.R. 73.682(a)(22)) is decoded into ASCII text by a

decoder in the closed-captioned television and displayed on the television screen. Another method of decoding is using the vertical blank interval of a transmitted television signal or speech to text conversion devices, both of which are well known in the art and will not be described in detail.

The decoded text information is supplied to the analyzing units 250 which determine whether a channel being monitored contains information of interest to the user. The analyzing unit 250 uses a user specified predefined list of data including "triggers" and items of channels stored in the profile unit 260 and the decoding text from the decoding unit 240 to determine which channels to display to the user. For example, the user may define a list of text of interest, such as monitoring the business channel so that anytime the word "Intel" is detected, the channel automatically pre-empts the current channel being displayed. The list of data stored in the profile unit 260 is prioritized so that the user is not overwhelmed with various channels with predefined items of interest for the user to watch at the same time. Particularly, the arbitrating unit 270 includes logic to determine which one channel to display on the display/record unit at any particular time. The arbitration logic is described in detail with reference to FIG. 4.

FIG. 3 is a block diagram illustrating an example of profile data in one embodiment of the profile unit 260. The profile unit comprises a priority storage location that stores priority data programmed by the user to prioritize each channel been monitored. When the priority data is set, channels with a high priority will always pre-empt channels with a lower priority in the display/record unit.

The profile unit 260 also includes a channel storage location for storing preprogrammed channel selections to be monitored by the preferred embodiment. The channel storage location is programmed using conventional channel programming methods known in the art. For example, if a particular user receives only a handful of channels, the user can program the channel storage locations of the profile unit with available channels received by the SPSU 104. Channel reception and representation may differ from one location to the other. For example, the music television channel may be represented as channel 11 in one location, and as channel 20 in another. The profile unit 260 of the preferred embodiment allows the user the flexibility to reprogram channel selections in the channel storage location.

The profile unit 260 further includes a trigger storage location and action storage location, for storing items of interest corresponding to each pre-programmed channel and the particular action to take once the trigger item is detected. The user programs specifies items of interest that are monitored by the analyzing unit 250 for each channel. Once the analyzing unit 250 detects the trigger text, the analyzing unit 250 reads the action storage location to determine what action to take. The action taken by the analyzing unit 250 depends on the priority of the current channel in the display unit and the contents of the action location corresponding to the channel being monitored. For example, the user may program channel 44, which happens to be a business news channel (e.g. CNBC), with a priority of one and the trigger text as "Intel stock". With a priority of one, anytime the captioned text "Intel stock" is detected in the video signal for channel 44 by the analyzing unit 250, channel 44 pre-empts any channel currently being displayed in the display/record unit. The user can switch to a pre-empted channel after receiving the information in the preempting channel, or choose to display the preempting channel (i.e. channel 44). Note that in the preferred embodiment, preempting a channel and the subsequent action taken by the analyzing unit 250 is automatic and predefined.

In the preferred embodiment, the user can reprogram the contents of the profile unit 260. That is, the user can change the channel information, the priority numbers of the channels being monitored, or the triggering text for each channel being monitored as well as the action to take once a trigger item is detected.

Reference is now made to FIG. 4 which is a flow chart illustrating the arbitration logic utilized by the arbitration unit of the preferred embodiment. As illustrated in FIG. 4, the arbitration logic starts at box 400 where the arbitrating unit 270 receives selected signals including the profile information from the analyzing unit 250.

At box 410, the arbitrating unit 270 receives and examines the contents of the profile information of a selected signal responsive to each channel being monitored from the analyzing unit 250. The profile information includes the priority, channel number and the action to be performed for each channel being monitored.

At box 420, the arbitrating unit 270 examines the selected signal to determine whether the priority information responsive to a channel information included in the selected signal is higher than a channel being displayed or recorded. If the priority of the selected signal is higher, processing continues at box 440; other processing continues at box 430 where the current arbitration process ends.

At box 440, if the priority of the selected signal is higher than the currently displayed channel, the arbitrating unit 270 instructs the display window to take action on the selected television signal to preempt a currently displayed window of a lower priority. For example, if the display unit has three channels with a priority of one, two and four being displayed, and the notified channel has a priority of three, the channel with a priority of four will be pre-empted. The same preemption logic applies if multiple channels are being recorded.

At box 450, once the arbitrating unit 270 has determined that a selected television signal supersedes a current displayed signal, the arbitrating unit 270 generates a notification signal to the pre-empted display to move to a different window if possible at box 410.

Reference is now made to FIG. 5 which illustrates an exemplary local area network (LAN) implementation of the preferred embodiment. As illustrated in FIG. 5, a client computer system 590 is coupled to a network server 550 via a local area network 599. The server 550 comprises a video signal converter 530 for converting video signals received by the server from a video transmission source such as a television broadcast station. The server 550 further comprises a plurality of server decoders 520 for decoding television signal received by the network server, a plurality of tuners 510 for receiving the television signal from a broadcast source, and a server LAN interface 540 for transmitting decoded television signal to the network. The computer system 590 comprises a client LAN interface 580 for interfacing the client "computer 590 to the network, a plurality of buffers 210 for temporarily storing decoded television signal received by the client computer 590, a profile unit 260, a plurality of analyzing units 250 for monitoring and selecting one or more channels of the television signal to be displayed in the client computer 590, an arbitrating unit 270 for arbitrating resource contentions among the analyzing units 250, and an output driver 560. In an alternate embodiment, one or more of the analyzing units 250, profile unit 260, arbitrating unit 270, and buffers 210 may be included in the server computer 550."

As illustrated in FIG. 5, the server 550 converts (decodes) a video signal in a receiving channel into a decoded digital

format, and sends the converted signal over the LAN 599 to the receiving client computer 590. The server 550 further sends textual information indicative of the video signal received by the server 550 to the client computer system 590.

The video signal converter 530 receives a video signal from the tuner 510 responsive to a channel from an input signal line 513. The video signal converter 530 subsequently converts the video signal into a digital signal and transmits the converted signal to the server LAN interface 540.

The LAN interface 540 receives the textual output from the server decoder 520 and the digital signal from the video signal converter 530 and transmits the decoded digital signal to the LAN 599. The protocol used by the LAN 599 is well known in the art and is not described in detail.

The interface between the client LAN interface 580 and the server LAN interface 540 is such that the client LAN interface 580 receives the assembled data from the server LAN interface 540 over the LAN 599, and disassembles the textual output and the corresponding digital signal responsive to each channel. The client LAN interface 580 "sends the digital signal to the buffers 210 for storage for a predetermined period of time, and the textual output to the analyzing units 250.

The analyzing units 250 analyze the textual output from the client LAN interface 580, and compare it to profile information stored in profile unit 260 to determine whether a predefined pattern of interest is present. If a predefined pattern is present, the analyzing units 250 signal the arbitrating unit 270 of the detection, indicating the particular channel of the digital signal stored in buffers 210 to which the respective predefined pattern corresponds. The arbitrating unit 270 sends control signals indicative of user commands to output driver 560. The control signals control channel selection for the client computer, selecting from the channels of the digital signal stored in buffers 210.

The output driver 560 receives the control signals from the arbitrating unit 270, and, in response to the control signals outputs the respective television channel or channels stored in buffers 210. The control signals may indicate a number of predefined user actions stored as profile information in profile unit 260. For instance, in addition to channel selection the control signals can include turning on and off a display window and adjusting audio volume in the client computer's display window in the client computer system 590."

Thus a method and apparatus for arbitrating between channels in a communication signal based on the textual contents of the signal has been described. From the above description, it will be apparent that the invention disclosed herein provides a novel and advantageous communication system. The foregoing discussion discloses and describes exemplary methods and embodiments of the present invention. As will be understood by those familiar with the art, the invention may be embodied in other specific forms without departing from its spirit or essential characteristics, and thus, the described embodiment is not restrictive of the scope of the invention. The following claims are indicative of the scope of the invention. All variations which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

1. An apparatus for controlling selective display and/or recording of selected ones of a plurality of channels of a communication signal, the apparatus comprising:

(a) one or more analyzing units for receiving textual information indicative of channel contents of said chan-

nels decoded from said communication signal, and responsive thereto, analyzing said received textual information to determine if channel contents of said channels are among channel contents defined by selection data; and

- (b) an arbitrating unit coupled to said one or more analyzing units to arbitrate display and/or record resource contentions among said analyzing units determining said channels having channel contents that are defined by said selection data.

2. The apparatus of claim 1 wherein said arbitrating unit includes an arbitration logic routine for arbitrating said display and/or record resource contentions, in accordance with predefined priority information of said selection data.

3. The apparatus of claim 1 wherein the apparatus further includes one or more decoding units coupled to said one or more analyzing units for providing said textual information of said channels to said analyzing units, said one or more decoding units receiving said channels of said communication signal, and in response decoding said channels for textual information included in said channels.

4. The apparatus of claim 3, wherein the apparatus further includes one or more signal tuning units coupled to said one or more decoding units for providing said one or more decoding units with said channels, by tuning to said channels of said communication signal.

5. The apparatus of claim 4, further comprising one or more buffers coupled to said one or more tuning units for storing portions of the contents of said channels of said communication signal for a predetermined duration of time.

6. The apparatus of claim 1 wherein the contents of said channels include audio/video contents, and said selection data include predefined priority of said audio/video contents.

7. The apparatus of claim 1 wherein said selection data include predefined keywords and priorities of selected ones of said channels.

8. The apparatus of claim 1, wherein said arbitrating unit automatically causes a display window for displaying the channel contents of a successful one of said arbitrating channels to be activated, amplification of audio signals associated with the activated display window to be adjusted, and/or channel contents of said successful one of said arbitrating channels to be recorded.

9. The apparatus of claim 1, wherein the apparatus further includes a profile unit coupled to said one or more analyzing units for providing said one or more analyzing units with said selection data.

10. The apparatus of claim 9, wherein said profile unit has a first state in which portions of said selection data are added to storage locations of said profile unit, and a second state in which portions of said selection data are deleted from storage locations of said profile unit.

11. A computer system having a bus for communicating information, and a signal processing unit coupled to said bus for processing a signal having a plurality of channels, said signal processing unit comprising:

- (a) one or more analyzers to receive textual information indicative of channel contents of said channels decoded from said signal, and responsive thereto, to analyze said received textual information to determine if channel contents of said channels are among channel contents defined by selection data; and
- (b) an arbitration unit coupled to said one or more analyzers to arbitrate display and/or record resource contentions among said analyzers determining said channels having channel contents that are defined by said selection data.

12. The computer system of claim 11 further comprising a display unit including a plurality of display windows for displaying channel contents of successful ones of said arbitrating channels.

13. The computer system of claim 11 wherein said selection data include priorities of selected ones of said channels.

14. The computer system of claim 11, wherein the computer system further includes a profile unit coupled to said one or more analyzers for providing said one or more analyzers with said selection data.

15. The computer system of claim 14, wherein said profile unit includes a first and a second portion, and wherein said first portion is defined to store information about selected ones of said channels, and said second portion is defined to store information about successful ones of said arbitrating channels.

16. The computer system of claim 15 wherein said profile unit has a first state in which portions of said selection data are added to storage locations of said profile unit, and a second state in which portions of said selection data are deleted from storage locations of said profile unit.

17. The computer system of claim 11 wherein said arbitrating unit automatically causes a display window to be activated for displaying channel contents of a successful one of said arbitrating channels, amplification of audio signals associated with said display window to be adjusted, and/or channel contents of a successful one of said arbitrating channels to be recorded.

18. The computer system of claim 11 further comprising one or more recorders for recording channel contents of successful ones of said arbitrating channels.

19. The computer system of claim 11, wherein the computer system further includes one more decoders coupled to said one or more analyzers for providing said textual information of said channels to said one or more analyzers, said one or more decoders receiving said channels of said signal, and in response decoding said channels for textual information included in said channels.

20. The computer system of claim 19, wherein the computer system further includes one or more tuners coupled to said one or more decoders for providing said one or more decoders with said channels, by tuning to said channels of said signal.

21. A communication network system comprising:

- (a) a communication network interface to communicate in said communication network system;
- (b) a communication network server coupled to said communication network interface to receive a signal having a plurality of channels; said communication network server to generate a stream of decoded texts indicative of channel contents of said channels, responsive to said channels; and
- (c) a client computer system coupled to said communication network interface to receive said channels and said decoded texts from said network server, to analyze said received decoded texts to determine if channel contents of said channels are among channel contents defined by selection data, and to arbitrate display and/or record resource contentions among analyzed channels with channel contents that are defined by the selection data.

22. The communication network system of claim 17 wherein said communication network server comprises:

- (b.1) one or more tuners to tune to said channels;
- (b.2) one or more decoders coupled to said one or more tuners to receive said channels, and to generate said decoded texts indicative of channel contents of said channels;

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(b.3) one or more buffers coupled to said one or more tuners to temporarily store portions of the channel contents of said channels for a predetermined duration of time; and

(b.4) a server interface coupled to said buffers and said decoders to couple said communication network server to said communication network interface.

23. The communication network system of claim 21 wherein said client computer system comprises:

(c.1) an analyzer coupled to said communication network interface to perform said analysis; and

(c.2) an arbitration unit coupled to said analyzer to perform said arbitration.

24. A method for controlling rendering of a signal having a plurality of channels, said method comprising:

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(a) analyzing textual information decoded from a signal having a plurality of channels to determine whether channel contents of said channels are among channel contents defined by selection data; and

(b) arbitrating display and/or record resource contentions among said analyzed channels having channel contents defined by said selection data.

25. The method of claim 24 wherein (a) includes tuning to said channels to receive said channels, and decoding textual information included with said channels.

26. The method of claim 24 wherein (a) includes pre-defining said selection data employed in said analyzing step.

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